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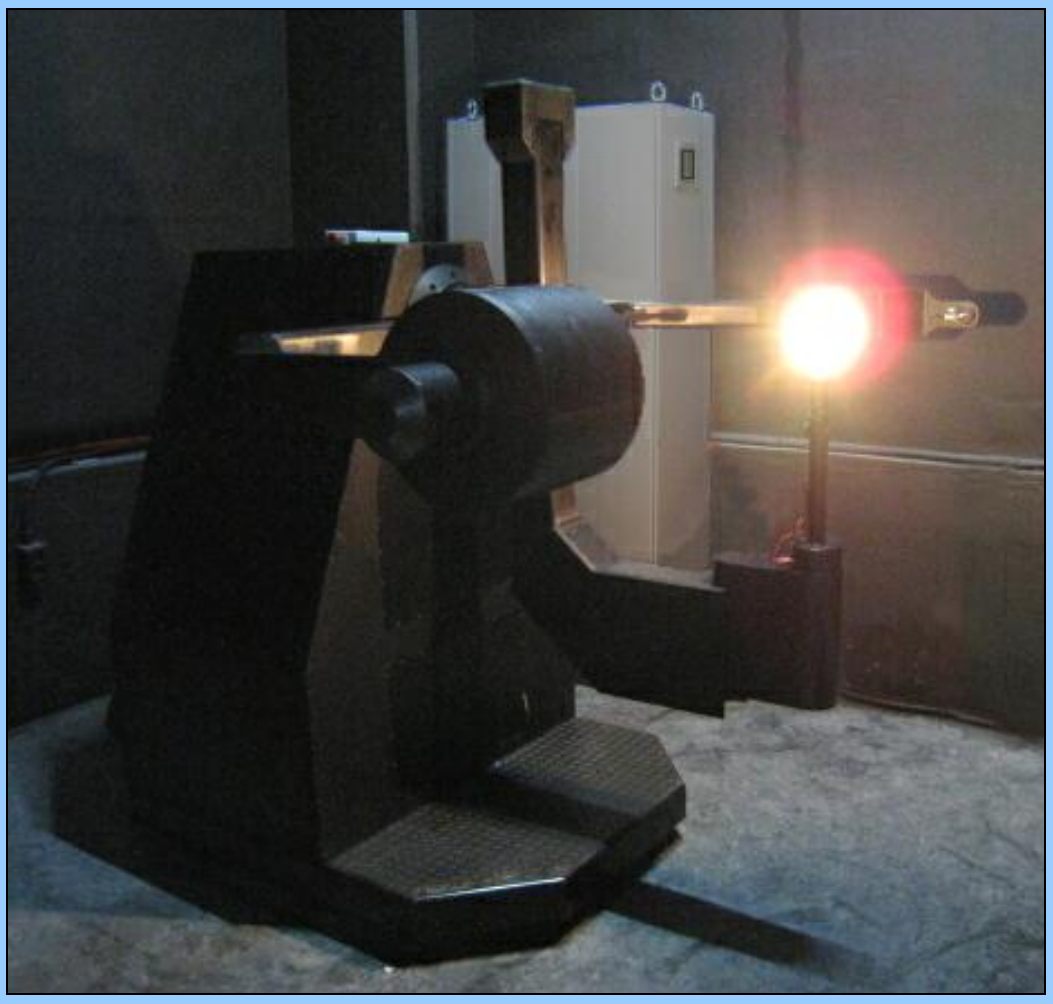
THE NEW GENERATION IN PHOTOMETRIC TECHNOLOGY



# ALFI

## Absolute Luminous Flux Integrator

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# ALFI – Absolute Luminous Flux Integrator

## Theory of Operation

The Absolute Luminous Flux Integrator (ALFI) is a special device designed for absolute measurement of luminous flux of lamps. Its secondary use is also to measure the luminous intensity distribution of small lamps and luminaires.

The test item is placed on a rotating lamp holder in the centre of the device. A photometer head is mounted on an arm that rotates about the lamp. The lamp's rotation presents different C-plane angles to the photometer head, and when the photometer arm rotates the photometer head sees different elevation angles of the lamp. By rotating through all of the C-planes and executing a sweep of the elevation angles within each C-plane, the luminous flux is summed over the whole sphere around the test item.

The photometer head is connected to an amplifier with a built-in data acquisition card for analogue-to-digital conversion and an RS 485 interface for communication with software in the PC. The amplifier can also receive digital triggering from the motor controller for accurate angle positioning during fast measurement scans.

During the process of a luminous flux measurement, the ALFI is actually measuring the illuminance on the detector, and converting this to the luminous intensity emitted by the lamp in all of those directions. So therefore, the illuminance and luminous intensity distribution may also be derived during this test.

Because the test distance is small, the luminous intensity distribution is only relevant if the size of the test item is small compared with the test distance (the distance from the pivot to the photocell). This is a fundamental rule of photometry for conversion from illuminance to luminous intensity.

Because of the small test distance and the sensitivity of the detector, this device is ideal for measuring the luminous flux and luminous efficacy of lamps, LEDs, LED clusters, OLEDs, Carbon Nanotube products and other lighting devices including flat panel displays and small luminaires.

The ALFI is a detector-based photometric measurement equipment. No standard lamps are required to calibrate the system, however they can always be used to crosscheck the system accuracy. Once the ALFI's photometer is calibrated, it can then produce luminous flux standards to calibrate other photometric equipment such as Mirror Goniophotometers, and Integrating Spheres. A gloss trap is positioned on the photocell arm opposite the photocell so that stray light is minimised when measuring small test items.

## Specifications

There are two standard models: the ALFI-1.0 and the ALFI-2.0. The ALFI-1.0 is a compact flux integrator designed to fit into a standard room height. A summary of the specifications is as follows:

- Can support test items up to 5 kg;
- Includes motorised vertical adjustment of 100 mm;
- Measurement radius (reference plane of photocell to goniometer pivot point) = 1.000 metres;
- Includes incremental and absolute angular encoders with 0.1° angular accuracy and 0.005° angular resolution;
- Will fit in room with ceiling height of 2.5 m or greater;
- Can measure luminous flux of test items up to 1200 mm;
- Can measure luminous intensity distribution (and illuminance distribution at 1.0 metres) of test items up to 100 mm (except for test items with tightly focussed optics or narrow beam angles);

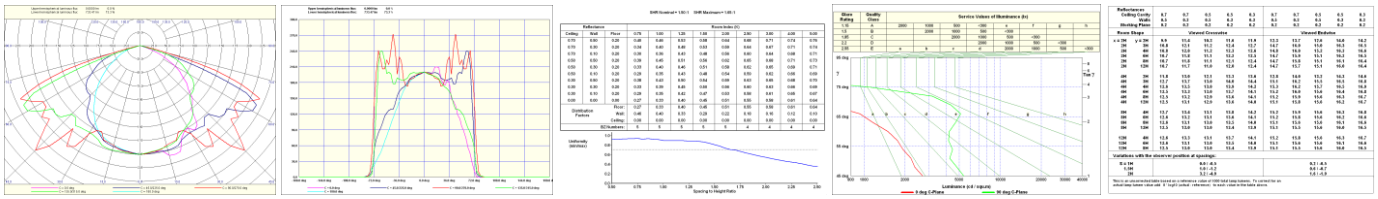
The ALFI-2.0 is a larger sized, high-end flux integrator for measurement of the luminous flux of practically all types of lamps. *Please contact PSI for system specifications on this model.*

Both models can measure in vertical base-up, vertical base-down and horizontal burning positions, or any angle in between with motorised adjustment. The inset picture shows measurement in vertical base-down configuration.

All systems come with a cosine-corrected, temperature-stabilised photocell (stabilised at 35.0°C) with V (lambda) correction ($f_1$' < 1.5). They also include a built-in alignment laser and wireless remote hand-held controller.

A slip ring is used to provide power to the test item and voltage feedback. Options for electrical supply and measurement include:

- One or two 6.5 digit digital multimeter for measuring the electrical parameters.
- A source measurement unit for supplying current waveforms to LEDs and measuring the electrical parameters.
- Other AC or DC power sources according to the types of devices to be tested by the system.



## IESNA LM-79-08 Functionality

The ALFI systems maintain the light source in its designed burning position, thus it complies with the IES LM-79 for goniophotometry of LEDs and Solid State Lighting (SSL) devices.

With the addition of a power analyser, the system also measures the Luminous Efficacy. For small light sources where the luminous intensity distribution can be measured, the software also outputs the Zonal Lumen Density for various angular ranges.

With the addition of a spectroradiometer such as PSI's SP-3C Real-time Spectroradiometer, the system can then measure the spatially-averaged Chromaticity Coordinates and Correlated Colour Temperature, and can calculate the Colour Spatial Uniformity, as required by some Energy Star standards.

## Software

The software that comes with the system is in two parts: control software to operate the equipment and report generation software to produce printed output. The big advantage of dividing the software into these two separate parts is that the report generation software can be installed onto other PCs so that reports can be produced while other measurements are being performed.

The control software that comes with the ALFI is capable of performing measurements of luminous flux and also luminous intensity distribution. It will interface all of the devices attached to the system, including the power supply and power analyser for luminous efficacy calculations.

When the software initialises, it checks all devices attached to the system to check that they are working properly. In the event of a failure or misbehaviour of one or more of the devices, an error message should be shown indicating which device is not functioning correctly and the most probable cause of the problem.

The control software has the flexibility to give the operator all of the control that he needs, and is not restrictive and rigid. Features include:

- Ability to specify test angles and angular increments;
- Ability to take measurements "on the fly" without stopping;
- Bare lamp luminous flux measurement or luminous intensity distribution measurement or both;
- Facility for monitoring the stability of test items;
- Joystick control for arbitrary rotations of goniometer axes;
- Ability to set multiple calibrations, which are then selected according to lamp type (required for highest accuracy measurement);

The report generation software is also flexible. The user can select which pages are to be included in a report so that the report may be customised according to each client's needs. Features of our report generation software include:

- Ability to customise contact details and logo which appear on the printed pages;
- Test details with uncertainties of measurement;
- Polar curves and H-V plots – with ability to zoom in on lowest 10% regions to study spill-light;
- IsoCandela diagrams – Azimuthal projection format for Type C/$\gamma$ and H-V format for Type A/$\alpha$ and Type B/$\beta$;
- IsoLux diagrams – basic types only are needed here as there are many types of professional lighting-layout software available;
- IsoLux greyscale format;
- IsoLux 3D format;
- Luminance table;
- Luminous flux summary table;
- Tables of coefficients of utilisation – both the IESNA and CIBSE TM5 formats;
- Utilisation factor diagrams for streetlights;
- Zonal flux diagram;
- Luminance limiting curves (glare rating);
- UGR Tables – Full and Reduced;
- CIBSE LG3 rating (glare control for VDUs);
- Ability to display a digital image of the test item in the report for easy identification;

The IsoLux, IsoCandela and IsoLux 3D format diagrams have options for line contour or shading formats, and the user can specify the values of the contours.

In addition to the control and report generation software, other photometric software utilities can be provided to perform such tasks as:

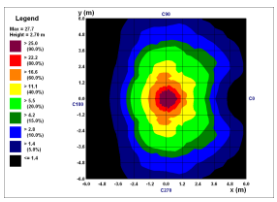
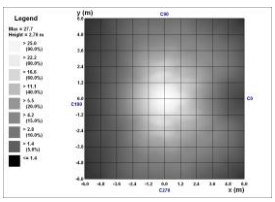
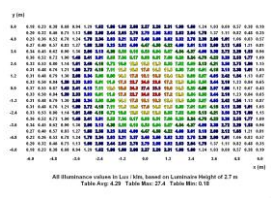
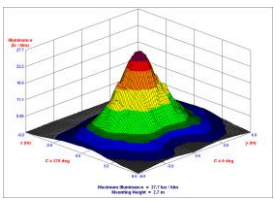
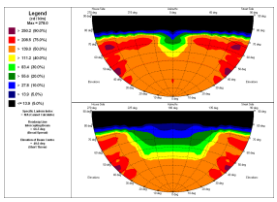
- Edit, modify and manipulate the photometric data which was acquired during measurement – also called post-processing of the data;
- Display and print additional charts and diagrams derived from the measurement data;
- Perform lighting layout design for interior and exterior applications using the measurement data.

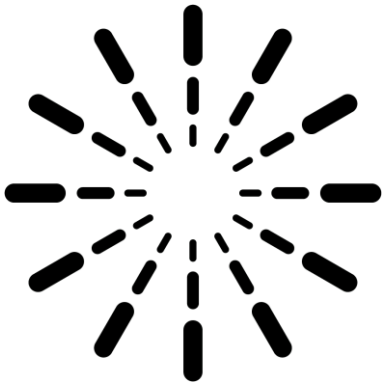
## Installation & Training

PSI staff have decades of experience in running education programmes including:

- Fundamental concepts;
- Basic principles of photometry;
- Use of the equipment and best practice;
- Determination of uncertainties of measurement.

**Please contact one of our representatives or sales/applications engineers for more information.**



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